REMARKS

Independent Claims 1 and 6 define a polycrystalline alumina ceramic arc tube having magnesium oxide of 200 ppm or below wherein the crystal grain diameter of the polycrystalline alumina ceramic is G (μm) and satisfies the following equation:

$$0.5 \leq G \leq 1.5.$$

See the teachings on Page 4, Lines 9-20 of our present specification.

Thus, we are able to provide a high efficient lamp whose arc tube wall is made of a polycrystalline alumina ceramic having a transmittance of 94% or greater.

As noted on Page 5, Lines 9-20, the advantages of our present invention are recognized as follows:

> Please note that it is confirmed that cracks are more effectively restrained by adjusting the crystal grain diameter G (μm) of polycrystalline alumina ceramic to be in a range of 0.5 to 1.5, inclusive.
>
> In addition polycrystalline alumina ceramic having low reactivity with the enclosure is obtainable if alumina powders, to which MgO of 200ppm or below is added, are sintered. If a lamp has a main tube part made of such polycrystalline alumina ceramic, the lamp is able to sustain a favorable luminous flux maintenance factor for a long time. This is instrumental in providing a metal halide lamp having a long life.

The above parameters of our invention are defined in relationship to an actual arc tube as set forth in each of the independent claims. That is, they are describing the actual main tube part after it has been appropriately mixed in a powder form, molded to a tubular shape, dried and sintered to the final product configuration. As a result of an elevated temperature in sintering, the polycrystalline alumina ceramic with the magnesium oxide supports a specific crystal grain diameter within the range mentioned above.

Thus, the actual crystalline grains in the finished arc tube meet these requirements.

As will be discussed with regards to the cited references, this is an important feature to understand in distinguishing our present invention over the prior art.

The Office Action contended that each of the claims were obvious over a combination of *Keijser et al.* (U.S. Patent No. 6,300,729) when taken in view of *Oda et al.* (U.S. Patent No. 4,214,666).

As noted on Pages 2 and 3, the Office Action acknowledged that the *Keijser et al.* reference "does not expressly disclose that the ceramic is a polycrystalline alumina having magnesium oxide of 200 ppm or below and that $0.5 \leq G \leq 1.5$ is satisfied, where a crystal grain diameter of the polycrystalline alumina ceramic is G(μm), as claimed by Applicant."

Thus, the lynch pin of this §103 rejection depends upon an alleged teaching found in the *Oda et al.* reference. The Office Action stated on Page 3, as follows:

> Oda is cited to show a lamp with a ceramic body that has a crystal grain diameter of alumina of 1 μm and contains magnesium oxide with 200 ppm or less (column 2, lines 1-13).

The support in the Office Action, with regards to the *Oda et al.* reference, is allegedly found in the following statement in Column 2, Lines 1-13:

> Alumina powder having a purity of 99%, preferably more than 99.9% and an average particle size of not more than 1 μm is added and thoroughly mixed with 0.01 to 0.2% by weight of MgO, 0.01 to 0.2% by weight of La_2O_3 and 0.01 to 0.2% by weight of Y_2O_3 and then the resulting mixture is formed into a tubular shape. The thus shaped tube is thoroughly dried, heated at a temperature raising rate of about 100° C./hr in a hydrogen gas atmosphere and then sintered at a temperature of 1,600248 to 1,800° C. for a period of 2 to 5 hours to obtain a tubular discharge envelope composed of the polycrystalline transparent alumina according to the invention.
>
> (underline added)

Applicant, however, respectfully traverses this assertion since this is a reliance upon "average particle size of not more than 1 μm in the alumina powder." The cited section refers to

the powder mixture of material which is subsequently "formed into a tubular shape." The tubular shaped tube is then dried and heated at a temperature that enables sintering between 1,600° to 1,800° C. for a period of two to five hours.

As a result, crystal grains grow and have an ordered deposition of molecules to create a crystalline state, usually with a regular repetition in a three dimensional space of an object.

As recognized in the *Oda et al.* reference, the polycrystalline transparent alumina is created as a result of this sintered operation so that the particular size of the crystal grains in the arc tube is defined within a range of 20 to 60 μm, as set forth in Column 2, Lines 30-32, of *Oda et al.*:

> Therefore, the average crystal grain size of the polycrystalline transparent alumina should be limited to a range of 20 to 60 μm.
>
> (underline added)

This teaching is reaffirmed in Table 1 in Column 3, wherein the average crystal grain size ranges from 22 to 55 μm. As can be determined further, the transmittance was 94.2% to 92.6%.

Further comparison can be made with the luminous efficiency of Table 3 having a maximum value of 129.5 for an average crystal grain size of 55 μm and also a failure or Cracking ratio of 5%.

As noted on Page 26 of our present invention, we successfully provide product with a lifecycle of no cracks having a luminous efficiency of 134 Lm/W with no crack observed over 9,000 hours. This is also for a particularly long thin arc tube.

Our present invention provides better performance than any hypothetical combination cited in the Office Action rejection, while clearly having claim parameters that are not taught by any of the cited references.

In summary, neither the *Keijser et al.* reference or the *Oda et al.* reference teaches that a finished arc tube product has a crystal grain diameter of a polycrystalline alumina ceramic within $0.5 \leq G \leq 1.5$.

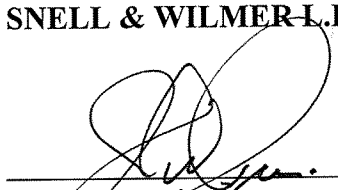
Oda et al. only teaches an alumina powder with a powder particle size of not more than 1 μm which is then mixed with other powders and then subsequently sintered to provide the polycrystalline transparent alumina. The average crystal grain sizes in the crystalline transparent alumina of the *Oda et al.* reference is in a range of 20 to 60 μm.

It is respectfully submitted that our current claims are allowable over the art of record and an early notification of the same is requested.

If the Examiner believes a telephone interview will help further the prosecution of this case, the undersigned attorney can be reached at the listed phone number.

Very truly yours,

SNELL & WILMER L.L.P.



Joseph W. Price
Registration No. 25,124
600 Anton Boulevard, Suite 1400
Costa Mesa, California 92626-7689
Telephone: (714) 427-7420
Facsimile: (714) 427-7799